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# Why Beam Studies



- Last Week's CDF Meeting
  - 14-21 April: Consistent good stores > 3.5e31
  - 22-23 April: Tev studies
    - » Nigel asked why? (more specifically why now?)
- Beam studies in general
- Specific things done last week

# Why studies in general?



- Maintenance:
  - Keep the machine in a good operational state
    - » Think quiet time calibrations….
  - Optimize for current conditions
  - Takes time as changes at both 150 and 980 have to be matched to ramp and squeeze conditions - have to take beam all the way through the cycle on both proton and pbar helices
  - Known state for future studies work
- Improvements
  - Spend time working on current known problems and limitations
    - » e.g., adjust orbit to make use of C0 aperture
    - » Though have made use of C0 Lambertson removal to lower chromaticities and increase proton intensities (lowered the machine impedance and hence raised instability thresholds)

# Why Studies in general?

- Run II Upgrades Lehman Review, July 2003
  - Two Fronts: ~$14M M&S
    - » x3 in Pbar stacking rate

      Slip Stacking  Target Station  Acceptance

      Stacktail cooling  Electron Cooling  Recycler integration
    - » Tevatron improvements to handle 3x pbar current

      Active Beam-Beam compensation  Increased Separation
  - Does not include possible new magnet construction
    - » 6.6 T magnets -> shorter so more space for separators?
- Paper models won't cut it…
  - Current Performance limited by beam-beam interactions
    - » 150 GeV lifetime
    - » Pbar emittance blowup at injection
  - Need measurements to justify expenditures

- Dedicated time more efficient for these measurements

# Why orbit smoothing?



## Motivation for smoothing

**Orbit drifts ~0.5 mm/week** → **Tune changes of ~0.001** → **Emittance blowup Poor lifetime**

**Orbit drifts ~1.0 mm** → **Aperture problems** → **Losses and quenches**

# Goal for orbit smoothing



Find a set of **"Golden Orbits"** with beam

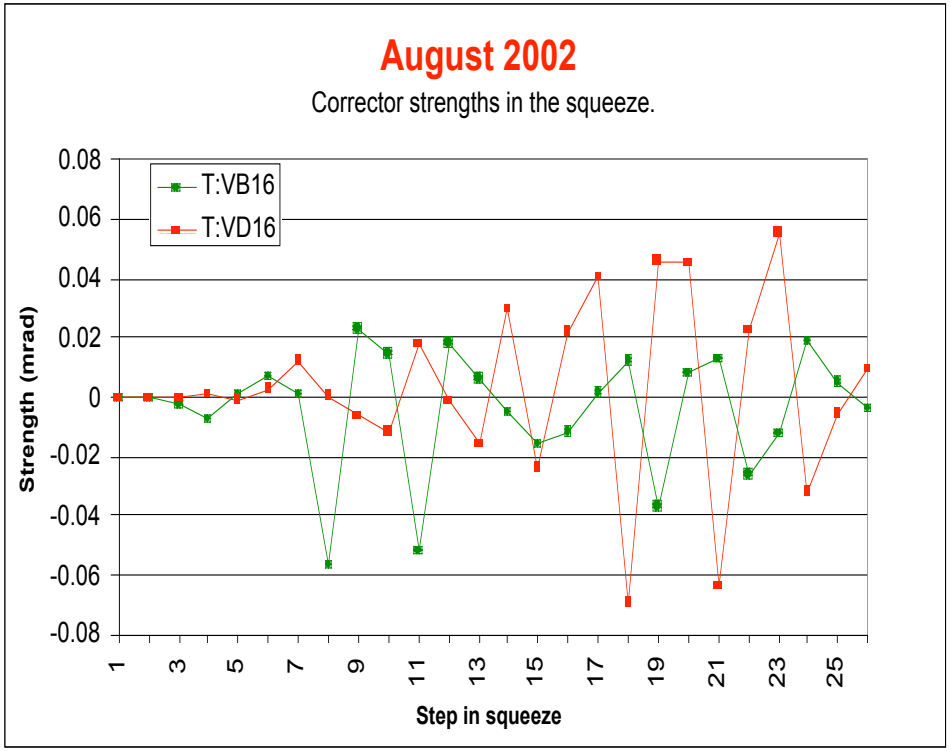
- in the center of the magnets.
- in the center of aperture at tight spots.
- at the correct location for injection and abort.
- at a good location for experiments.

Develop a **"Standard Smoothing Procedure"** that

- keeps the orbits stable.
- is done consistently.
- can be done relatively quickly.

Ongoing since last summer -- had reached stable state this spring

# Some History of Orbit Smoothing




Corrector strengths fluctuating by 50 amps during the squeeze.

In August 2002.

Found erratic orbits and corrector settings.

⇩

Overhauled the orbits corrector setting.

⇩

Developed a "standard smooth procedure"

# More History of Orbit Smoothing



**Standard smoothing worked well until Mar 2003.**

Then things got "mucked up" due to:

- A "non-standard smooth" (and a software change.)
- ~0.5 mm orbit drifts from an unnoticed C:B0QT3 trim quad error.
- ~0.5 mm orbit changes from unnoticed TEL magnetic corrector trips.
- Some backwards BPMs.
- Possible "stale orbit data" ??

- Orbits were not where we wanted.
- Correctors running near their 50 amp limit.
- Standard smoothing procedure no longer worked.

# 22-23 April work

Smoothing on 4/22/2003

- Reduced current in correctors.
- Reduced slew rates in correctors.
- Kept (or tried to keep) positions in straight sections the same.
- Put orbits in center of magnets in the arcs.
- Lowered A0 abort block by 3 mm.

- Had to retune the Tev. (Tunes changed by 0.01)
- Should be able to perform a “standard smooth.”

- Came out with good stores … 3-3.5e31 initial luminosity